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Research Highlights

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Subject Categories: Carbon nanotubes and fullerenes | Nanosensors and other devices

Gas sensing: Platinum platform

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Highly sensitive platinum-coated carbon nanotubes can detect much lower levels of carbon monoxide than other nanotube-based sensors

Japanese environmental regulations stipulate that the concentration of carbon monoxide in the air must be less than 10 p.p.m. Compared with conventional metal-oxide gas sensors, devices based on single-walled carbon nanotubes (SWNTs) coated with catalytic metallic nanoparticles offer the advantages of low power consumption, compactness and potentially very high sensitivity. However, the sensitivity towards carbon monoxide of even the best Pd-coated SWNT gas sensor is currently limited to 10,000 p.p.m.

Now, Mitsuhiro Katayama and colleagues[1] from Osaka University and New Cosmos Electric Company Limited in Osaka have developed platinum-decorated SWNT gas sensors that are able to detect carbon monoxide at concentrations as low as 1 p.p.m. The Pt-SWNT sensors were produced by electron-beam evaporation of a 0.5–5.0 nm layer of Pt on to a thin film of SWNTs. During this process, individual nanotubes were coated with 5-nm-diameter Pt nanoparticles, and the coverage density was found to increase with the thickness of the Pt layer.

The conductance of the Pt–SWNT structure decreases linearly with increasing carbon monoxide concentration between 1–10 p.p.m. This effect is caused by a room-temperature catalytic reaction, involving electron donation to the SWNTs as a result of the carbon monoxide being oxidized by the Pt catalyst. The sensitivity of the sensor depends on the thickness of the Pt film and it could be improved further by optimizing Pt particle size.

Reference

1. Wongwiriyapan, W. *et al.* Highly sensitive detection of carbon monoxide at room temperature using platinum-decorated single-walled carbon nanotubes. *Appl. Phys. Express* **1**, 014004 (2008). | Article |

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